

NBSIR 74-529

Project Plans

Fiscal Year 1974

Law Enforcement Standards Laboratory
Institute for Applied Technology
National Bureau of Standards
Washington, D. C. 20234

July 1973

Final

Prepared for
National Institute of Law Enforcement and Criminal Justice
Law Enforcement Assistance Administration
U. S. Department of Justice
Washington, D. C. 20530

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U. S. DEPARTMENT OF COMMERCE, Frederick B. Dent, Secretary

NATIONAL BUREAU OF STANDARDS, Richard W. Roberts, Director

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FOREWORD

Following a Congressional mandate* to develop new and improved techniques, systems, and equipment to strengthen law enforcement and criminal justice, the National Institute of Law Enforcement and Criminal Justice (NILECJ) has established the Law Enforcement Standards Laboratory (LESL) at the National Bureau of Standards. LESL's function is to conduct research that will assist law enforcement and criminal justice agencies in the selection and procurement of quality equipment.

In response to priorities established by NILECJ, LESL is (1) subjecting existing equipment to laboratory testing and evaluation and (2) conducting research leading to the development of several series of documents, including national voluntary equipment standards, user guidelines, state-of-the-art surveys and other reports.

A list of the documents already completed under the Law Enforcement Standards Program will be found on the inside back cover of this document.

The 1974 Project Plans for the Law Enforcement Standards Laboratory outline the approved research objectives and plans for the fiscal year starting July 1, 1973. The program of testing and evaluation described in the Project Plans has significant value for law enforcement and criminal justice agencies in the selection and procurement of quality equipment. This document is intended to present detailed information concerning this program so that all concerned agencies are aware of the ongoing research.

Comments and suggestions concerning these plans and future efforts in this area are invited from all interested parties. They should be addressed to the Program Manager for Standards, National Institute of Law Enforcement and Criminal Justice, Law Enforcement Assistance Administration, U.S. Department of Justice, Washington, D.C. 20530

*Section 402(b) of the Omnibus Crime Control and Safe Streets Act of 1968, as amended.

Project Plan for
Automatic Intrusion Detection Sensors

Marshall Isler, Program Manager
Security Systems

SCOPE

Automatic intrusion detection sensors are sensors used in an intrusion alarm system and are designed to detect a specific stimulus generated by an intruder into a protected site. They may be designed to detect infrared energy, motion, noises and vibrations characteristic of a physical attack, the opening of a door or window, etc. They may be used in conjunction with an audible alarm (bell on the premise), a silent alarm to a local guard, or be linked to a police station either directly or indirectly through a commercial central station service.

BACKGROUND

Intrusion alarm systems provide a useful tool for law enforcement agencies in apprehending burglars. However, the increasing popularity of alarm systems is causing an increasing frequency of false alarms, resulting in a significant drain of police resources. The false alarm rate is as high as 90 to 95 percent throughout the country as determined by several studies (Crime Against Small Business--SBA; False Alarm Study by the Alarm Industry Committee for Combating Crime; Cedar Rapids Report on Test and Evaluation of Burglar Alarms) and confirmed by direct contact with several police departments (District of Columbia; Montgomery County, Md.; Boston, Mass.; and others). The causes of these false alarms run the gamut from procedure or operator error to system (equipment) performance. The sensor is the weakest link in the equipment performance; therefore, the objective of this project is to develop a standard for each category of sensor, addressing reliability with primary emphasis on false alarm susceptibility. These standards can then be used by the consumer for procuring reliable systems and by local municipalities for regulating the quality of alarm systems in their jurisdiction, when such quality affects their police resources.

There are standards in this area produced by the Underwriters' Laboratories, General Services Administration, Department of Defense, and the Atomic Energy Commission. Generally, these equipment standards are concerned with hardware reliability and ability to detect the intruder, and not with false alarm susceptibility. In addition, these standards do not provide the quantitative performance test methods required of a NILECJ standard. However, an attempt will be made to utilize the data in, and where possible not to conflict with these existing standards.

PROPOSED PLAN

In general, the development of these standards consists of identifying performance attributes that relate to reliability and false alarm susceptibility, establishing minimum performance levels, and designing test methods and procedures for measuring performance. The pertinent attributes are determined from manufacturers' specifications, user requirements and laboratory tests. Minimum performance levels are based on existing equipment capability as determined by laboratory evaluation of representative commercial equipment and on user requirements. Test methods and procedures are developed in the laboratory based on, as much as possible, standard engineering measurement practices and test equipment.

There are a great many sensors available on the market that sense many different phenomena associated with an intruder. Any combination may be used to protect a particular site, depending upon the nature of the item being protected and the operating environment. Since the optimum array will be unique for a given environment, and since the environment cannot be standardized, the approach will be to develop for each category of sensor a performance standard which will include characterization of those environmental factors which tend to degrade performance.

The types of sensors addressed in FY-73 were (1) magnetic switches, (2) mechanical switches, (3) mercury switches, (4) contact vibration sensors, (5) window foil, (6) audio sensors, (7) microphone vibration sensors, (8) hold-up devices, (9) ultrasonic motion detectors, and (10) microwave motion detectors. The standards development process for items (3) through (10) will be continued in FY-74. In addition, standards for capacitance proximity sensors, photoelectronic sensors, and passive infrared sensors will be initiated. For each of these sensors the standard will generally establish minimum performance levels and test procedures for the following.

1. sensitivity range
2. sensitivity stability
3. false alarm modes and sensitivity
4. hardware failure detection
5. tamper detection
6. reliability

During the development of each sensor standard, LESL will maintain close liaison with industry, the Underwriters' Laboratories, and government laboratories working in this area. An Industry Review Committee has been established to assist in the review phase of the standards development process. This committee represents the National Burglar and Fire Alarm Association, the Security Equipment Industry Association, and the Alarm Industry Committee for Combating Crime. Also included in this review phase is a group of users government agencies, American Bankers Association, the Jewelers Alliance Association, and a major insurance company.

OBJECTIVES

The following standards were promulgated in FY-73.

- Standard for Magnetic Switches
- Standard for Mechanically Actuated Switches

The following standards will be completed in FY-74.

- Standard for Contact Vibration Sensors
- Standard for Mercury Switches
- Standard for Window Foil
- Standard for Audio Sensors
- Standard for Microphone Vibration Sensors
- Standard for Hold-up Devices
- Standard for Ultrasonic Motion Detectors
- Standard for Microwave Motion Detectors

The following standards will be initiated in FY-74.

- Standard for Capacitance Proximity Sensors
- Standard for Photoelectric Sensors
- Standard for Passive Infrared Sensors

The projected milestones are given in the attached table.

LEVEL OF EFFORT

	<u>FY-73</u>	<u>FY-74</u>	<u>FY-75</u>
Standard for Contact Vibration Switches	5,000		
Standard for Mercury Switches	5,300		
Standard for Window Foil	16,400		
Standard for Audio Sensors	26,200	6,300	
Standard for Microphone Vibration Sensors	12,000	12,600	
Standard for Hold-up Devices	5,100	25,100	
Standard for Ultrasonic Motion Detectors	15,000	33,800	
Standard for Microwave Motion Detectors	15,000	33,800	
Standard for Capacitance Proximity Sensors		18,800	19,800
Standard for Photoelectric Sensors		18,800	19,800
Standard for Passive Infrared Sensors		<u>31,400</u>	
	<u>100,000</u>	<u>180,600</u>	<u>39,600</u>

AUTOMATIC INTRUSION DETECTION SENSORS

Milestones*

Objectives	Assumed Starting Date	#1	#2	#3	#4
Standard for Contact Vibration Sensors	Continuing	Completed	Completed	Completed	October 1973
Standard for Mercury Switches	Continuing	Completed	Completed	Completed	Sept. 1973
Standard for Window Foil	Continuing	Completed	Completed	July 1973	December 1973
Standard for Audio Sensors	Continuing	Completed	Completed	July 1973	December 1973
Standard for Microphone Vibration Sensors	Continuing	Completed	July 1973	October 1973	April 1974
Standard for Hold-Up Devices	Continuing	Completed	October 1973	November 1973	May 1974
Standard for Ultrasonic Motion Detectors	Continuing	Completed	November 1973	December 1973	June 1974
Standard for Microwave Motion Detectors	Continuing	Completed	December 1973	January 1974	June 1974
Standard for Capacitance Proximity Sensors	Dec. 1973	March 1974	June 1974	August 1974	January 1975

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

AUTOMATIC INTRUSION DETECTION SENSORS

Milestones*

Objectives	Assumed Starting Date	#1	#2	#3	#4
Standard for Photoelectric Sensors	Dec. 1973	March 1974	June 1974	August 1974	January 1975
Standard for Passive Infrared Sensors	August 1973	November 1973	April 1974	June 1974	December 1975

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Physical Security Systems for Doors and Windows

Marshall Isler, Program Manager
Security Systems

SCOPE

The purpose of this project is to develop security performance standards, a component selection guide and glossary of terms and definitions for door and window systems. The standards will define minimum performance levels for a given threat level, and include test procedures for measuring performance. The standard will address each component of the system, since the integrity of the system is no greater than that of its weakest link. For example, when addressing a door system, the standard will consider the type of door (material, construction, operation, etc.), the frame construction, the hinges, and the locking device. The standards will address the performance of doors and windows used in residences and small businesses with respect to the common threats.

Two standards are being developed, one for doors and another for windows. Each standard will define performance criteria for each type of system and component against a defined threat, and a test procedure for evaluating each type. The selection guide will present evaluation data in a manner to enable the user to select a mix of components to meet an assumed threat level. This provision for the user to select components to meet his particular needs in terms of threat level is critical to the flexibility and utility of the standards, since the threat level and resources of the user will vary considerably. Some of the potential users and areas of application of the standards include: single homes, multiple dwellings, small businesses, public buildings, city ordinances, building codes, Federal agencies (HUD, FIA), and insurance companies.

BACKGROUND

The number of reported incidents of burglary in 1970 as reported in the 1970 Uniform Crime Report was 2,169,300--an increase of 11 percent over 1969. The associated losses

totaled \$672 million, of which \$407 million were from residences and \$265 million nonresidences. With respect to nonresidential losses, the impact to the losses is a direct function of the size of the business. The percent of the nonresidential losses for business with receipts under \$100,000 was 3.2 times the average and 35 times that of businesses with receipts over \$5 million. These statistics illustrate the magnitude of the burglary problem, and the fact that the major burden of the losses are borne by residences and small businesses. Two of the reasons why these establishments are vulnerable are: (1) home owners and small businessmen do not have the technical expertise to optimize their security to meet the anticipated threat, and (2) building codes do not specify security requirements. Therefore, the original security fixtures of the structure are often inadequate. The LESL effort will provide a means to correct these deficiencies, and thereby decrease burglary vulnerability.

PROPOSED PLAN

The following tasks are being conducted in the development of the standards, guide and glossary. The development of the standard for windows and the standard for doors are parallel efforts. The attached flow chart illustrates the relationships among the tasks.

- Task 1 Categorize types of door and window systems. For example, a door may be categorized by its operation, i.e., fixed swing, sliding, or rolling, single or split.

- Task 2 Categorize components of each type. This would include a delineation of the materials and construction for both door/window and frame, and the hardware (hinges, locks, etc.) associated with each type.

- Task 3 Develop test methods. This will consist of selecting the pertinent security performance characteristics of the system and components, and selecting existing test methods or developing new methods for measuring the characteristics.

- Task 4 Define threats. The threats will be determined as a function of the sophistication level of the attacker, the kinds of tools used, and the time to defeat. Some forms of attacks that will be considered are brute force (pressure against the door distributed among all components; glass breaking), tool attacks against the door (drilling; sawing), surreptitious attacks against locks (picking), tool attacks against door knob, attacks against locking bolt (hacksaw; hammer-bar), and attacks against door frame (knifing; wedging). This task will rely heavily on data from existing related NILECJ studies.
- Task 5 Define security levels. Three levels will be defined that will cover the spectrum of threats defined in Task 4. Again, maximum utilization will be made of existing NILECJ studies.
- Task 6 Establish minimum performance levels for each component of the system consistent with the defined security level. For example, the components of a door system are the door, penetration resistant glass or grills (if used), frame, hinges, and locking device. Minimum performance levels for the system will be established in a manner to enable the user to select combinations of components to meet a particular security level.
- Task 7 Perform tests on sample systems and components. These tests will be conducted for the purpose of validating test methods, determining state-of-the-art with respect to performance of existing equipment, and rating types of components for the selection guide.
- Task 8 Prepare the standards for review by NBS and external sources, and for submission to NILECJ.
- Task 9 Assess risk to typical establishments based on statistical data. This task will assess the burglary risk to typical residential and commercial establishments will be assessed as a function of type (as defined by the Department of Commerce and several NILECJ studies), location, and burglary patterns. The sources of data to be used will include the FBI Uniform Crime Reports, Crime Against Small Business, UL's Field Service Record of Certificated Burglar Alarms, several books on security, and the NILECJ studies referred to in Task 4.

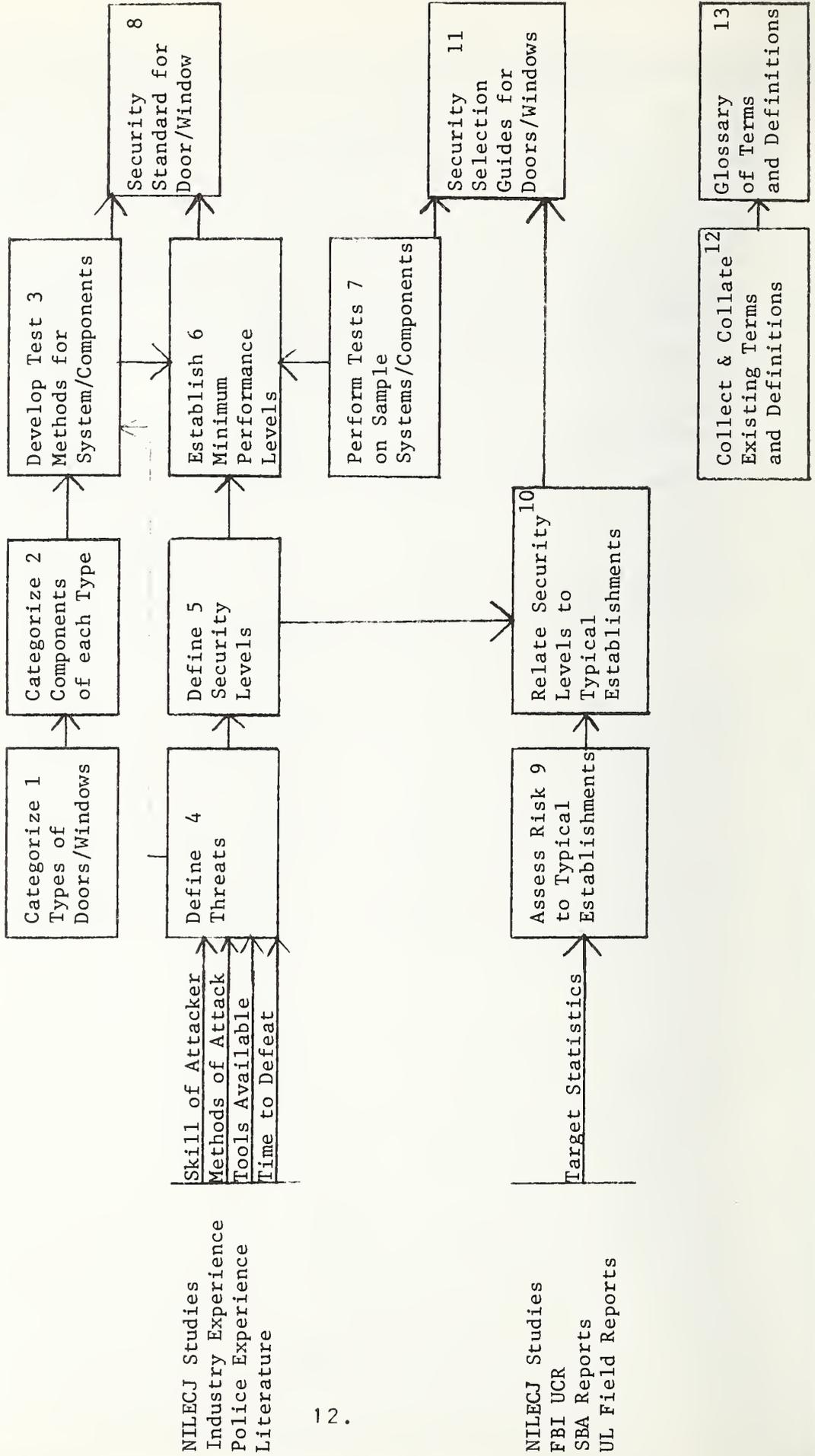
- Task 10 Relate security levels to typical establishments. The appropriate security levels as defined in Task 5 will be selected for the typical establishments as a function of the risks defined in Task 9. This will assist the user of the guides in selecting the most appropriate choice of security level for his particular establishment.
- Task 11 Prepare security selection guide for doors and windows. The guide will present the recommended security levels for typical establishments, and associated matrices of systems and types of components that can meet the particular security level.
- Task 12 Collect and collate material for a glossary of terms and definitions. This will consist literature search of existing definitions, with additions and modifications as appropriate.
- Task 13 Prepare glossary of terms and definitions. This includes drafting the document, coordinating an NBS external review, modifying as appropriate, and submitting recommended document to NILECJ.

In FY-73, LESL completed tasks 1, 2, 4, and 5, and initiated tasks 3 and 7. The interim standards will address the most common types of window and door systems and the lower two of the three levels of security defined in task 5. These levels involve the most common threats to residences and small businesses. Following these interim standards, the remaining common types of window and door systems and components will be evaluated and performance levels will be established for the remaining security level. The security selection guide for doors and windows and the glossary of terms and definitions will also be developed in FY-74.

LEVEL OF EFFORT

	<u>FY-73</u>	<u>FY-74</u>	<u>FY-75</u>
Interim Standard for the Security of Doors	60,000	20,000	0
Interim Standard for the Security of Windows	60,000	20,000	0
Standard for the Security of Doors	0	80,000	10,000
Standard for the Security of Windows	0	80,000	10,000
Guide for the Security of Doors and Windows	0	40,000	0
Glossary of Terms and Definitions	<u>0</u>	<u>10,000</u>	<u>0</u>
	120,000	250,000	20,000

TASKS TO THE DEVELOPMENT OF PHYSICAL
SECURITY STANDARDS FOR DOORS AND WINDOWS



Milestones*

Objectives	Assumed Starting Date	#1	#2	#3	#4
Interim Standard for the Security of Doors	Continuing	Completed	July 1973	September 1973	March 1974
Interim Standard for the Security of Windows	Continuing	Completed	July 1973	October 1973	April 1974
Standard for the Security of Doors	July 1973	Completed	February 1974	May 1974	November 1974
Standard for the Security of Windows	Continuing	Completed	February 1974	June 1974	December 1974
Guide for Door and Window Security	July 1973	October 1973	NA	March 1974	July 1974
Glossary of Terms and Definitions	July 1973	January 1974	NA	April 1974	August 1974

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Police Alarm System Annunciators

Marshall Isler, Program Manager
Security Systems

SCOPE

The police alarm system annunciator is an indicator and display module used in a police station to receive burglary and robbery alarms from remote sites. Generally, it consists of a set of indicator lights that display the status of the system at each protected site: secure or access mode, and alarm or trouble condition. The initial alarm indication is provided by a bell or buzzer.

BACKGROUND

The rising rates of burglary and robbery and the corresponding demands of insurance companies have significantly increased the popularity of burglary and holdup alarms. In most areas of the country these alarms may be received directly by an annunciator located in the police station. Because of the various secure communications schemes used to transmit the alarm signal, and marketing pressures for new features, some manufacturers' models of protected-site equipment necessitate the use of their particular annunciators in the police station. In addition, annunciators may vary significantly in functions and displays due to the absence of an accepted standard design. As a result, there exists today a proliferation of different annunciators with a variety of functions and displays; various sizes, which are incompatible with each other; and various communication schemes and sensor control panels. This situation adversely affects the performance of the police in operating and maintaining such systems, and in many cases may limit the number of annunciators a department can install.

PROPOSED PLAN

The objective of this project is to develop a functional design standard for the annunciator panel that will

emphasize commonality of displays and functions, and modularization of displays to allow an increase of capability through a "building-block" approach. Since the project initiation in FY-73, LESL has requested and received design data from manufacturers. These data have been reviewed in order to identify the distribution of functional features and electromechanical interface requirements. Some of these existing features, along with others which are deemed appropriate, will serve as the basis for establishing the standard. LESL will also purchase a selected sample of these devices for examination and evaluation in the laboratory as part of its standard development process.

OBJECTIVE

The objective of this project is a standard for police annunciators. The projected milestones are given in the attached table.

LEVEL OF EFFORT

	<u>FY-73</u>	<u>FY-74</u>
Police Annunciator Standard	40,000	9,400

POLICE ALARM SYSTEM ANNUNCIATORS

Milestones*

Assumed Starting Date	#1	#2	#3	#4
Continuing	Completed	September 1973	November 1973	June 1974

Objectives

Standard for Police Annunciators

- *Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.
- *Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.
- *Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.
- *Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Guides for burglary Alarm Systems

Marshall Isler, Program Manager
Security Systems

SCOPE

The purpose of this project is to develop a series of documents directed toward the consumer that will assist him in selecting burglar alarm systems and components for his particular application. The two types of documents being prepared are selection guides for burglar alarm components and systems and a glossary of burglar alarm terms and definitions.

BACKGROUND

Alarm systems have played a major role in the deterrence of burglary and the apprehension of burglars. The present rising burglary rate has significantly increased the demand for such systems. Consequently, the market is flooded with devices and systems covering a wide spectrum of sophistication and quality, all claiming to be the ultimate in protection. Generally, the consumer is not informed enough to determine which devices or systems are most appropriate for his needs, nor can he afford an independent consultant for professional advice. Therefore, there is a need for tutorial documents that will assist the consumer in making rational decisions.

PROPOSED PLAN

The glossary of terms and definitions will consist primarily of existing terms and definitions accepted by industry, written in a form useful to the consumer. The approach will be to survey existing documents, extract applicable data, modify those data as appropriate, develop new definitions where necessary, and coordinate a review by industry, potential users, and other interested parties. The first draft of this document was completed in FY-73.

The burglar alarm selection guides will be a series of documents which will provide rationale and trade-off factors for selecting alarm devices for a particular environment. The three documents that have been either initiated or planned will address the commercial, the residential and the outdoor institutional environments respectively. Each guide will assist the user in making decisions in the following areas:

1. The need for alarm systems with respect to the threat level.
2. The type of coverage and area to be protected.
3. The appropriate sensor or array of sensors.
4. The appropriate type of system (local or silent).
5. If silent, the appropriate type of service.

The following considerations will be addressed with respect to the above decision areas and the particular environment:

1. Availability of equipment or service.
2. Resistance to defeat.
3. Installation.
4. Effect on normal operating procedures.
5. False alarm susceptibility.
6. Cost.

Development of the guides for commercial establishments and for residences was initiated in FY-73. Development of the guide for institutions (outdoor) will be initiated in FY-74.

OBJECTIVES

See the attached table for a list of the objectives and for the projected milestones.

LEVEL OF EFFORT

	<u>FY-73</u>	<u>FY-74</u>
Glossary of Burglar Alarm System Terms and Definitions	10,000	6,300
Guide for the Selection of Commercial Alarm Systems	15,000	50,000
Guide for the Selection of Residential Alarm Systems	5,000	32,000
Guide for the Selection of Outdoor Institutional Alarm Systems	<u>0</u>	<u>25,100</u>
	30,000	113,400

Milestones*

Objectives	Assumed Starting Date	#1	#2	#3	#4
Glossary of Burglar Alarm System Terms and Definitions	Continuing	Completed	NA	Completed	October 1973
Guide for the Selection of Commercial Alarm Systems	Continuing	Completed	NA	December 1973	April 1974
Guide for the Selection of Residential Alarm Systems	Continuing	September 1973	NA	February 1974	June 1974
Guide for the Selection of Outdoor Institutional Alarm Systems	Sept. 1973	January 1974	NA	June 1974	October 1974

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Video Tape Recording Systems for Courtroom Use

Marshall Isler, Program Manager
Security Systems

SCOPE

The purpose of this project is to develop a guideline written for the consumer that will assist him in understanding video tape recording (VTR) systems and to develop performance standards for VTR systems applicable to courtroom use. The guideline will help the consumer to understand the usefulness and the limitations of VTR systems and to negotiate intelligently with the seller. It will deal with VTR equipment that could be used for collecting and presenting investigative evidence, depositions, and testimonial evidence, and for the video recording of court proceedings for record purposes. Courtroom use of closed circuit TV will also be considered.

BACKGROUND

Under the sponsorship of NILECJ, the NBS Technical Analysis Division recently completed a study of the potential uses of court related video recording. One conclusion was that recording may be used in several ways to provide limited, immediate help in reducing the congestion in court calendars and in improving the "quality of justice." The present use of VTR in television broadcasting, as well as the potentially huge market in home recording, has propelled many manufacturers into the field with the result that the manufacturers' literature is simply overwhelming. Some features of VTR systems are more useful than others and some guidance through this technical maze is necessary. The above mentioned study also concluded that performance requirements should be developed for court-oriented video systems. As a result of these conclusions and related NILECJ experience, NILECJ has included in its adjudication program a project to develop voluntary standards for video tape systems for courtroom use, and identified the ESIP Standards Group to perform the task.

PROPOSED PLAN

It is proposed that this project consist of two phases. Phase one will identify equipment performance characteristics and design features pertinent to courtroom operation, and phase two will determine minimum requirements for those identified characteristics and will develop or identify existing applicable test methods. The outputs of these two phases will constitute the primary inputs to preparing the standards.

Phase one will be initiated by reviewing the equipment recommendations presented in the aforementioned NBS study, and then updating the operational requirements through visits to courtrooms where such systems are installed on an experimental basis and through discussions with related NILECJ grantees. The equipment characteristics pertinent to the operational requirements will then be identified. The pertinent performance and design characteristics will be identified for the field equipment used to collect evidence and witness depositions, and for the fixed equipment used in the courtroom. The design characteristics addressed will be based on interface requirements among the system components, including those between field and courtroom equipment. The results of this phase will be used in preparing the guideline, and will form the basis for developing the standard.

Phase two will determine minimum performance levels and required design features based on the outputs of phase one and the capability of existing commercial equipment. The latter will be determined by evaluating manufacturers' literature and selected sample equipment. There are certain desired design features already identified in the NBS study which are not now commercially available. These features will be considered for incorporation into the standards based on technical feasibility, cost, and operational importance. If any such features are considered inappropriate for the standards at the present time, they will be recommended as items for future development within the ESIP program. Test methods for measuring all identified performance characteristics will be developed. The outputs of this phase will be draft standards for the courtroom systems, and for the related field equipment.

OBJECTIVES

Guide for Selection of Courtroom Video Equipment
Standards for Courtroom Video Tape Recorder Systems

LEVEL OF EFFORT

	<u>FY-73</u>	<u>FY-74</u>	<u>FY-75</u>
Phase one	25,000		
Phase two		75,000	25,000

Milestones*

Objectives	Assumed Starting Date	# 1	# 2	# 3	# 4
Guide for Selection of Courtroom Video Equipment	Continuing	Completed	NA	August 1973	November 1973
Standard for Courtroom VTR Systems	July 1973	November 1973	June 1974	August 1974	February 1974

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Base Stations, Transceivers and Accessory Equipment

Marshall J. Treado, Program Manager
Communications Systems

SCOPE

The items of equipment involved in this project include the transmitters, receivers and antennas which are components of base stations and transceivers as well as fixed repeaters.

BACKGROUND

As society in general and the police in particular have become more mobile, the demand for more and better communications equipment has increased. Many agencies now require that all officers on duty be in constant communication with the dispatcher. As their requirements have increased, these agencies have purchased new and more sophisticated communications equipment. Recent technological advances in electronics, meanwhile, have resulted in many improvements, notably in miniaturization and packaging. These advances have not only improved the capability of this equipment, but have made it lighter, smaller, more reliable in the field and easier to maintain, without significantly changing its cost. In many cases this equipment now operates with increased power capability, significantly more channels and for longer periods of time. This added sophistication, coupled with the requirement to comply with Federal Communications Commission regulations as to power, frequency usage and electromagnetic interference have made this particular area an important one for the development of standards and guidelines. Standards are needed for fixed and base station transmitters, mobile transmitters, personal/portable transmitters, fixed and base station antennas, mobile antennas, fixed and base station receivers, mobile receivers and personal/portable receivers, and fixed repeaters.

PROPOSED PLAN

This project was initiated with a review of the products already on the market. There are approximately fifty industrial concerns making FM 2-way radios today. Some of these companies also produce base station equipment and repeaters. Each year, several of these organizations offer new or improved equipment for sale. LESL plans to determine

the characteristics to be used to describe the performance of each type of equipment being addressed. Concurrently, project personnel collect and review all existing standards for this equipment issued by organizations such as EIA, IEEE, ANSI, ASTM, APCO, SAE and IEC. If methods of evaluating equipment performance either do not exist or are not adequate, new or improved techniques will be developed and validated by trial use on representative operational equipment. Minimum performance requirements will be established based on these measurement techniques, the demonstrated capabilities of existing equipment, and the needs of the users.

For fixed repeaters, technical areas of concern are the amount of isolation required between the receivers and transmitters, the delays introduced into the system by the repeater, synchronization requirements, cabinet desensitization problems, the level of spurlous signal suppression required when in close proximity to multiple transmitters and the trade-offs between one and two frequency repeater systems.

OBJECTIVES

The objectives of this project during FY-74 will be to complete the development of the standards started in FY-73 and to develop the fixed repeater standard as indicated on the attached schedule.

LEVEL OF EFFORT

All work on this project will be performed at NBS. Funds in the amount of \$60,000 will be used as follows:

Fixed Repeater Standard	50,000
Completion of standards drafted in FY-73	10,000

REMARKS

The project was originally initiated in FY-72, and has been the nucleus of the LESL Communications Program. The standard for mobile antennas has been completed and standards are in process for the other equipment discussed above, except for fixed repeaters. Tests thus far have primarily been conducted on equipment loaned by manufacturers and have been limited to non-destructive testing. The estimated costs for this project do not include the purchase of major items of equipment to be tested.

BASE STATIONS, TRANSCEIVERS AND ACCESSORY EQUIPMENT

Milestones*

Objectives	Assumed Starting Date	#1	#2	#3	#4
Standard for Mobile Transmitters	Continuing	Completed	Completed	Completed	October 1973
Standard for Fixed and Base Station Antennas	Continuing	Completed	Completed	July 1973	November 1973
Standard for Fixed and Base Station Transmitters	Continuing	Completed	Completed	August 1973	January 1974
Standard for Personal/Portable Transmitters	Continuing	Completed	Completed	August 1973	January 1974
Standard for Mobile Receivers	Continuing	Completed	Completed	September 1973	April 1974
Standard for Fixed and Base Station Receivers	Continuing	Completed	Completed	October 1973	May 1974
Standard for Personal/Portable Receivers	Continuing	Completed	Completed	October 1973	May 1974
Standard for Fixed Repeaters	August 1973	February 1974	May 1974	July 1974	January 1975

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Voice Scrambling Equipment

Marshall J. Treado, Program Manager
Communications Systems

SCOPE

This project deals with voice scramblers used with law enforcement communications equipment.

BACKGROUND

Recent increases in criminal activity have caused a corresponding increase in the need for effective law enforcement voice radio communications. However, their effectiveness has been substantially reduced by the proliferation of readily available inexpensive radio receivers, which are used by criminals to intercept police transmissions. Accordingly, many police agencies place the attainment of more secure communications by means of voice scrambling equipment at, or near, the top of their list of priorities. The equipment priority survey conducted for NILECJ by NBS found that about 10 percent of the agencies queried had voice scramblers and over 50 percent more wanted them. Unfortunately, agencies that express a need can rarely agree on the type of equipment, the operational procedures, or the basic technical characteristics required. They also cannot agree on the depth of sophistication required to counter criminal actions, or the amount they are willing to pay for such a capability. There appears to be a large trade-off between capability and cost in the equipment being marketed.

There are a substantial number of voice scramblers available for law enforcement applications. However, there is virtually no standardization among these units, nor are there any performance standards. At present, the prospective customer has no technical guidelines to follow in selecting the optimum unit for his needs, nor does he have a way of comparing the performance of one unit with another. Even though voice scramblers have been in regular use for about 30 years, these earlier applications have been quite specialized and limited, and no generally recognized performance standards have evolved.

This project was initiated in FY-71 with the long range goal of developing a performance standard for voice scramblers. These results to date are summarized in a report now being written. The major finding is that standards of performance are needed in three main areas. These are privacy against eavesdropping, intelligibility of the reconstituted signal and compatibility with existing equipment.

PROPOSED PLAN

The proposed plan is to test in the laboratory a representative group of commercially available voice scramblers. Initially, use will be made of existing measurement procedures that can be modified to fit the special characteristics of voice scramblers. Project personnel will utilize existing communication system standards, including NILECJ standards when available, to explore and define the compatibility of scramblers with communication equipment.

Voice testing, using standardized text material and word lists, will be used to measure intelligibility. Tests will also be made to determine whether alternative methods can be used to obviate the need for voice tests. The search for an objective means of defining and measuring voice privacy will be continued.

OBJECTIVE

The objective for FY-74 is to develop a standard for voice scramblers. The projected milestones are indicated in the attached chart.

LEVEL OF EFFORT

This is estimated to be \$70,000 during FY-74. The work is to be performed at NBS.

REMARKS

This project was initiated in FY-71 when \$4,000 was committed for a preliminary study of voice scramblers. Funding during successive years was \$20,000 in FY-72 and \$30,000 in FY-73.

Milestones*

Assumed Starting Date	#1	#2	#3	#4
Continuing	Completed October 1973	Completed January 1974	August 1973 March 1974	November 1973 October 1974
Continuing				

Objectives

Report on Voice Scrambling Equipment and Techniques

Standard for Voice Scramblers

- *Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.
- *Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.
- *Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.
- *Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Mobile Digital Communications

Marshall J. Treado, Program Manager
Communications Systems

SCOPE

The equipment involved in this project comprises the digital terminal in the police car and the corresponding piece of equipment at police headquarters.

BACKGROUND

The present congestion of the frequency spectrum used by FM two way police radios mandates that means for better utilization of this spectrum be found. One of the ways of accomplishing this is to develop and use digital techniques to send messages presently transmitted by voice. Accordingly, the development of digital equipment for this purpose and its purchase and installation has been given a high priority by many law enforcement agencies. Use of digital techniques will not only improve the speed of transmission, it will make more effective use of available spectrum and provide additional security to transmissions. The use of voice cannot be eliminated completely, particularly for calls of a non-routine nature, but digital techniques can be used to handle a large majority of the present voice traffic; i.e., those of a status nature. The use of digital equipment also lends itself to the provision of a permanent record, and it further provides a capability for data transfer directly to and from state and national data banks.

PROPOSED PLAN

During FY-73, a study was initiated to prepare a report on digital communications equipment used by law enforcement agencies. One objective of this study is to determine the suitability of typical items of digital equipment for use by these agencies. Another is to identify the attributes that should be addressed in a standard. Upon completion of this study effort, a mobile digital equipment standard development program will be initiated. Based on a group of inputs including the necessity for one or two way transmission, predicted error rates, requirement for hard copy printout, type of message format, and trade-offs as to displays, keyboards and types of modulation, minimum performance requirements with corresponding methods of test will be postulated and validated in the laboratory to produce the required standard.

OBJECTIVES

The objective of this project is to develop a performance standard for mobile digital terminals used by law enforcement agencies. The schedule for this development is shown on the attached milestone chart.

LEVEL OF EFFORT

The funding for this phase of the project is 83K, 8K of which is needed for laboratory support to be furnished by NBS. The remaining 75K will be used to develop test methods, determine performance requirements and write the standard. This will probably be accomplished by an industrial concern with expertise in digital communications, such as the company presently performing the study phase of this project.

REMARKS

Approximately \$50,000 of FY-73 funds have been allocated to defray the costs of the study phase of this project.

MOBILE DIGITAL COMMUNICATIONS

Milestones*

Objectives	Assumed Starting Date	Milestones*			
		#1	#2	#3	#4
Report on Mobile Digital Communications Equipment	Continuing	Completed December 1973	August 1973 August 1974	November 1973 October 1974	January 1974 May 1975
Standard for Mobile Digital Equipment	Continuing				

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Communications Equipment Used in Undercover Operations

Marshall J. Treado, Program Manager
Communications Systems

SCOPE

The items of equipment involved in this project are the transmitters, receivers, recorders, transcribers and other associated equipment used in undercover operations.

BACKGROUND

The tremendous advances in transportation and communication in the past decade have given criminals the capability of rapid movement of people and products and almost instantaneous contact with confederates in any part of the country and most of the rest of the world. Technological improvements in communications equipment have produced items that are capable of handling large amounts of information in a more secure manner, using miniaturized equipment that is more reliable and less costly. In order to counter certain of these criminal activities, law enforcement agencies must engage in undercover operations, placing police officers as members of suspected groups or on special patrol or stakeout duty. These officers usually cannot be in uniform nor carry noticeable or identifiable radio equipment. This illustrates the need for miniature receivers, transmitters, recorders, and other associated equipment. The project described herein has been established to develop those standards needed by law enforcement agencies to assist them in their selection and procurement of this type of communications equipment.

Since November 1972, a study has been in progress to gather information regarding the needs of law enforcement agencies for various types of radio equipment in undercover operations, and also to learn what equipment is commercially available to meet these needs. Both law enforcement personnel and manufacturers have been consulted, and some equipment has been laboratory tested to determine the parameters and criteria which are critically important for reliable and successful undercover communications. Included in the study have been such devices as miniaturized transmitters, receivers, tape recorders, microphones, and a variety of wired equipment of the type used to monitor telephone communication. A report with recommendations is scheduled for completion in September 1973.

PROPOSED PLAN

The plan has been to examine the items of equipment now on the market. Laboratory testing has been initiated to determine their effectiveness in the transmission of voice communications, their ability to transmit without revealing their location, their range of operation, ease of employment, and susceptibility to interference, and the overall effectiveness of their use in covert operations. These test results are being used to write a report which will include recommendations as to the performance criteria which should be addressed in a standard. These performance characteristics will include such items as power output, frequency stability, spurious emissions and sensitivity. The next phase of this project will yield performance standards for undercover transmitters and their accompanying receiver/recorders.

OBJECTIVES

The objectives of this project in the coming year are the development of performance standards for undercover transmitters and their accompanying receiver/recorders. The projected milestones are shown on the attached chart.

LEVEL OF EFFORT

This work will be performed at NBS and will cost \$45,000.

REMARKS

\$40,000 was spent on this project during FY-73.

Milestones*

Objectives	Assumed Starting Date	#1	#2	#3	#4
Report on Undercover Transmitters and Associated Equipment	Continuing	Completed	July 1973	September 1973	December 1973
Standard for Undercover Transmitters and Associated Equipment	July 1973	September 1973	January 1974	March 1974	October 1974

- *Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.
- *Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.
- *Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.
- *Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Audio Tape Recorders for Courtroom Use

Marshall J. Treado, Program Manager
Communications Systems

SCOPE

This project is concerned with the development of standards for audio tape recording systems that are used to record courtroom proceedings.

BACKGROUND

A few courts are now using audio tape recorders to record their proceedings. This technique offers the possible advantages of reduced costs, improved accuracy and quicker reproduction of transcripts. Some preliminary work has been accomplished in this area and the State of Alaska, with a scarcity of court reporters, has made the audio tape record of a trial the official record. Most jurisdictions are reluctant to follow this example, however, pointing to lack of knowledge of the equipment, or concern about accuracy and reliability the electronic components, or concern about disruption of the trial proceedings. Thus, standards for this equipment are needed in order that judges, attorneys and courtroom administrators can become more familiar with the capability of this equipment, and feel assured that the equipment they purchase will fill their needs.

PROPOSED PLAN

The proposed plan comprises several tasks. One is to obtain information through a literature survey, conversations with court officials, and firsthand observation. A second is to survey existing equipment available for this application and to review and evaluate existing performance requirements and test methods. If needed, new test methods will be developed. Performance levels will be determined by testing and evaluating presently used audio tape recorders. The final step will be to draft the standard. Some of these tasks may be accomplished concurrently. Upon completion of the first two steps, a user guideline for this equipment will be written. This guideline will discuss the operational considerations of the use of this equipment such as the role of the court reporter, insertion of off-the-record remarks, and provision for instant playback. Technical considerations will also be addressed in the user guideline. Some of these will be microphone placement and characteristics, room acoustics, equipment compatibility, performance monitoring and minor maintenance and repair of equipment.

OBJECTIVES

The two objectives of this project are to prepare a standard and a user guideline for audio tape recorders used in courtrooms. The scheduled milestones for these outputs are on the attached chart.

LEVEL OF EFFORT

\$25,000 was allocated to this project during FY-73 to initiate the program and prepare the user guideline. An additional \$100,000 is requested for FY-74 to complete the standard. The work will be performed at NBS.

AUDIO TAPE RECORDERS FOR COURTROOM USE

Milestones*

Objectives	Assumed Starting Date	#1	#2	#3	#4
User Guidelines for Audio Tape Recorders for Courtroom Use	Continuing	Completed	Completed	September 1973	December 1973
Standard for Audio Tape Recorders for Courtroom Use	July 1973	January 1974	April 1974	July 1974	February 1975

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for Trace Vapor Detectors

Robert Mills, Program Manager
Investigative Aids

SCOPE AND BACKGROUND

Trace vapor detectors are devices designed to indicate the presence of minute concentrations of explosive vapors. They can be used to check unopened packages or luggage, or to detect traces on the hands or clothing of persons who have recently handled explosives. In some cases, they can provide information about the type of explosive used, after an explosion has occurred.

A variety of trace vapor detectors are being developed or are available commercially. One example is a portable gas chromatograph with a special sampling and concentrating valve which will detect explosive vapors in the presence of large concentrations of other material. Another device monitors the luminescence of light-emitting (bioluminescent) organisms, which are sensitive to trace quantities of explosives in the surrounding atmosphere. The plasma chromatograph is another portable ionization type detector for which preliminary studies indicate an extremely high sensitivity to explosives and contraband materials. The explosive may be detected with high selectivity and identification capabilities by measuring the ion mobilities in a drift tube following ion molecule reactions at atmospheric pressure. Other instrumentation which is becoming available includes enrichment devices and separators coupled to mass spectrometers and electron capture detectors.

It is difficult for even knowledgeable technical people to know which of these instruments offer superior performance in important respects such as lower limit of detection, specificity, and response time. Test procedures which can be used to intercompare the performances of available instruments will therefore be extremely valuable and are needed in order for law enforcement groups to be able to specify performance. Manufacturers will also benefit by knowing the minimum performance levels for which they must design instrumentation in order to market a useful instrument.

PROPOSED PLAN

Due to the variety of trace vapor detector designs, a decision will have to be made concerning the scope of the standard or standards to be written. A single performance standard may be possible using language general enough for all types of detectors (e.g., gas chromatographs, bioluminescence instruments, etc.). However, it may be necessary to write a standard having specialized sections, or perhaps separate standards will be necessary. The milestones listed under Objectives assume a single standard will be written.

The most important test procedures in this standard will be the determination of lower detection limit and specificity. Both qualitative and quantitative information about the vapors from explosives are needed in order to devise a procedure to produce known trace concentrations of appropriate vapors. This information, plus information concerning the performance of available trace vapor detectors will be obtained from extensive laboratory tests at NBS, from other reputable laboratories, and from published material.

OBJECTIVES

The objective of this project is a standard for trace vapor detectors. The attached chart gives the projected milestones for FY-74.

LEVEL OF EFFORT

This is a continuing project which was initiated in FY-73. \$30,000 was budgeted in FY-73; an additional \$40,000 is requested to complete this project in FY-74.

TRACE VAPOR DETECTORS

Milestones*

Objectives	Assumed Starting Date	#1	#2	#3	#4
Standard for Trace Vapor Detectors	Continuing	Completed	March 1974	May 1974	December 1974

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for the Laboratory Evaluation of Handheld Metal Weapon Detectors

Robert Mills, Program Manager
Investigative Aids

SCOPE

It is planned to evaluate the performance of all models of handheld metal weapon detectors currently available in the United States by subjecting them to examination and testing in the laboratory. Both the passive magnetic and active electromagnetic types will be tested.

BACKGROUND

The use of weapons, particularly handguns, in connection with such crimes as airplane hi-jacking, prison breaks, etc., has created a widespread demand for means to detect concealed weapons. Several devices have been developed to meet this demand, including those known as handheld metal weapon detectors. These detectors have proven especially useful in detecting metal objects which have been concealed, for example, on a person, in a package, or in a prison mattress.

To fill the need for objective means of evaluating the effectiveness of the devices, the Law Enforcement Standards Laboratory has been developing a group of test methods, and a NILECJ standard on handheld metal weapon detectors has been drafted and is now being reviewed.

PROPOSED PLAN

Two samples of each available handheld metal weapon detector will be obtained. Some models have already been procured for use in the development of the standard. The remaining models will be bought from ordinary retail dealers.

All samples will be tested in accordance with the provisions of the draft NILECJ standard for handheld metal weapon detectors. This standard addresses the following factors, among others: detection ability; battery life; ambient operating temperature; generated magnetic field; alarm indicators and controls; operation near fixed metal walls; and interference from a near-by second detector.

The proposed NILECJ standard establishes four "security levels" or sensitivity levels, suitable for applications which range from screening for large weapons of people carrying their normal pocket items to searching for any metal item regardless of size. Each detector will be evaluated at every security level at which it is capable of being operated.

OBJECTIVE

A summary report will be prepared. The milestones are given on the attached chart.

LEVEL OF EFFORT

\$40,000 is requested for this project.

REMARKS

Since this project involves the use of the test methods in the proposed NILECJ standard on handheld metal weapon detectors now under review, the project will be initiated when it becomes apparent that no further substantive changes in these test methods are to be expected.

LABORATORY EVALUATION OF HANDHELD METAL WEAPON DETECTORS

Objectives	Milestones*				
	Assumed Starting Date	#1	#2	#3	#4
Summary Report of Laboratory Evaluation of Handheld Metal Weapon Detectors	Nov. 1973	December 1973	April 1974	May 1974	June 1974

- *Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.
- *Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.
- *Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.
- *Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Gunshot Residue Detection

Robert Mills, Program Manager
Investigative Aids

SCOPE

This project is for the development of a method for the detection of gunshot residues using neutron activation analysis, together with data on its reliability under a variety of circumstances.

BACKGROUND

Modern cartridge primers contain barium (Ba) and antimony (Sb) salts. Upon detonation of a cartridge, traces of these elements are deposited on the shooter's hand.

Two techniques are currently used to remove the Ba and Sb residues from the suspect's hand. One technique involves the application to the hand of melted paraffin in layers reinforced with gauze. The second technique involves the use of cotton swabs moistened with dilute nitric acid (HNO_3) to remove the residue. A third technique, not now in general use, involves wiping with a dry cotton ball after first moistening the hand with a spray of dilute HNO_3 .

Neutron activation analysis has proven to be a valuable method for measuring the amount of gunshot residue. Any Ba and Sb removed from the shooter's hand is made radioactive through the use of neutrons from a nuclear reactor. The gamma radiation emitted by this radioactive Ba and Sb salts is then determined by comparing it with the radiation from Ba and Sb standards. Concentrations of Ba and Sb significantly above background levels provide evidence that the suspect has fired a weapon in the recent past.

There are, of course, limits to the circumstances under which the collection and analysis of gunshot residues can be expected to give reliable results. For example, the amount of residue which remains on a suspect's hands is reduced if he showers, washes his hands or just sleeps in a bed. There have been cases where gunshot residue tests have been made even though it was known that the suspect had washed his hands several times after finger printing. The resulting questionable results have cast undeserved discredit on the entire technique. There is a need for a recommended procedure giving detailed instructions for gunshot residue collection and analysis which will give results of known reliability. There is also a need to carefully investigate the effect on the reliability when the test is conducted under less than optimum circumstances.

PROPOSED PLAN

This is an ongoing project. During the first nine months of the project, the following tasks have been completed (a) optimization of the procedure for analysis of the residue at the reactor, (b) perfection of the cotton ball technique for residue collection, (c) comparison of the relative efficiency and convenience of the three residue collection techniques mentioned above, and (d) measurement of the stability of residues on hands as a function of time after firing. In FY-74, measurements will be made of barium and antimony background levels on the hands of the general population. Finally, a statistically significant number of weapons and law enforcement investigators will be used to obtain data on method reliability under various operational conditions.

OBJECTIVES

The outputs of this project are (a) a recommended procedure for the analysis of gunshot residues using neutron activation analysis and (b) a recommended procedure for the collection of gunshot residues for analysis by neutron activation analysis. The attached table shows the projected milestones.

LEVEL OF EFFORT

\$45,000 was budgeted for FY-73. An additional \$30,000 is requested for FY-74 to complete the project.

GUNSHOT RESIDUE DETECTION

Milestones*

Assumed Starting Date	#1	#2	#3	#4
Continuing	Completed	Completed	September 1973	April 1974
Continuing	Completed	September 1973	November 1973	June 1974

Objectives

Recommended Procedure for the Analysis of Gunshot Residues

Recommended Procedure for the Collection of Gunshot Residues

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Analytical Techniques in Forensic Science

Robert Mills, Program Manager
Investigative Aids

SCOPE

This project comprises the development of standard methods for the examination and characterization of physical evidence, and for the preparation of standard reference materials of interest to the forensic sciences.

BACKGROUND

Forensic scientists characterize evidence in one of two ways. "Classification" is the process by which they identify the evidence as belonging to a particular subclass (e.g., a glass fragment as being auto headlight glass, or perhaps from an auto headlight made by G.E.). "Individualization", on the other hand, is accomplished when the unique identity of evidential material is established (e.g., a glass fragment as coming from the right headlight of a specific car).

Measurements made for forensic purposes must be made by precise and accurate methods to ensure that any observed variations are due to the characteristics of the material and not to the measurement process. Standard reference materials are needed by forensic laboratories for the calibration of their laboratory instruments, for the validation of their procedures, or for the confirmation of a classification by a direct comparison with the evidence.

In FY-73, LESL conducted a survey of the state-of-the-art of standard reference collections of forensic materials. The report of the survey findings constitutes an important part of the groundwork on which this project is based. The report is now being finalized and will be completed during FY-74.

PROPOSED PLAN

Glass and paint are the two materials of forensic interest to be addressed in FY-74 under this project; initial emphasis will be placed on automobile headlight glass and automobile paint. In general outline, the plan is to select the material characteristics most likely to be useful for forensic purposes, to adapt or develop the methods needed to measure these material characteristics with suitable precision, and to generate an exhaustive body of data on the actual characteristics of all available subclasses of the materials.

For automobile headlight glass, the relevant characteristics are expected to include refractive index, dispersion, and trace element profile. An extremely precise and accurate research method as well as one or more routine methods for the measurement of refractive index and dispersion will be

validated and used to measure these properties on all available varieties of automobile headlight glass. Neutron activation analysis, atomic absorption spectroscopy, and ultraviolet fluorescence spectroscopy will be investigated and the most suitable method or methods used to determine the minor element compositions of these same glass varieties. These data will be codified and published, as will the methods used in their determination. As deemed appropriate, based on the data obtained, standard reference materials will be developed and issued. It is planned to issue standard samples of both glasses and immersion liquids for use in refractive index measurements.

The attribute of automobile paint deemed of the greatest forensic interest is color. The visual, tristimulus, and spectrophotometric methods will be investigated, and the most suitable one used to characterize the large number of paints now in use on operational cars and trucks. The resulting data will be codified and made available to forensic scientists. A decision will be made later as to whether or not standard reference materials or collections should be developed and issued.

OBJECTIVES

The objectives of this project are 1) standard samples of refractive index glasses, 2) standard samples of refractive index liquids, 3) a compendium of the refractive indices and trace element profiles of automobile headlight glasses, 4) a similar compendium on window glasses, 5) a recommended method for glass refractive index measurement and 6) a compendium of automobile paint colors.

The project milestones are shown in the attached chart.

LEVEL OF FUNDING

A total of 220K is requested for this project for FY-74. An additional 160K will be requested for FY-75 to complete the listed objectives. The approximate allocation of these funds will be as follows:

	<u>FY-74</u>	<u>FY-75</u>
Glass		
Refractive Indices	60K	60K
Trace Elements	90K	60K
Auto Paint	<u>70K</u>	<u>40K</u>
	220K	160K

REMARKS

This project is a continuation of the FY-73 project entitled "Standard Reference Collections of Forensic Materials," which was budgeted at 30K.

ANALYTICAL TECHNIQUES IN FORENSIC SCIENCE

Milestones*

Objectives	Assumed Starting Date	#1	#2	#3	#4
Report on Standard Reference Collections	Continuing	Completed	NA	July 1973	November 1973
Standard Samples of Refractive Index Glasses	July 1973	September 1973	February 1974	NA	June 1974
Compendium of Auto Headlight Glass Characteristics	July 1973	September 1973	April 1974	June 1974	December 1974
Compendium of Auto Paint Colors	July 1973	March 1974	December 1974	February 1975	August 1975
Standard Samples of Refractive Index Liquids	April 1974	May 1974	October 1974	NA	February 1975
Compendium of Window Glass Characteristics	June 1974	August 1974	March 1975	May 1975	November 1975
Recommended Method for Glass Refractive Index Measurement	Dec. 1973	July 1974	October 1974	December 1974	July 1975

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Directory of Testing Laboratories

Robert Mills, Program Manager

SCOPE

This project will (a) locate and inventory testing laboratories which have indicated their capability for evaluating law enforcement equipment in accordance with test procedures outlined in NILECJ standards, (b) establish criteria for evaluating the qualifications of testing laboratories, and (c) begin a systematic appraisal of the qualifications of the inventoried testing laboratories. This will be an open ended project since the process of updating the directory and evaluating the laboratories will be a continuing one.

BACKGROUND

The utility to law enforcement officials of the performance standards promulgated by NILECJ will be greatly increased if ready means are established for identifying equipment which complies with the requirements of these standards.

Testing of hardware to check compliance with standards is referred to as compliance testing. Two types of compliance tests are of interest: product acceptance tests are performed to determine the acceptability of delivered items which have been purchased under a contract requiring compliance with the appropriate standard; product qualification tests are performed in advance of and independent of any specific procurement action for the purpose of establishing a "complying products list."

The large amount of product qualification testing which NILECJ may want to sponsor to develop complying products lists, and of product acceptance testing which local agencies need to check the quality of newly purchased equipment necessitates the involvement of private and public testing laboratories other than NBS. NBS's role is in the development of the standards and in the arbitration, if needed, of any disputes which may arise concerning compliance test results, but not in the compliance testing per se. If uniformly high standards of performance in compliance testing are to be maintained, laboratories must be selected which are competent and which are not, or even suspected of being controlled or influenced by manufacturers or distributors.

PROPOSED PLAN

Criteria for systematic and objective evaluations of testing laboratories will be developed for each standard. As a minimum, laboratories can be evaluated on the basis of information concerning laboratory personnel, laboratory facilities and test equipment, and management affiliations. Proficiency testing is also a valuable method when practical; candidate laboratories are asked to make tests on appropriate materials or equipment sent them, and are then evaluated on the results returned.

Once laboratory evaluation criteria are developed, independent testing laboratories will be invited to make known to LLSL their interest and qualifications for doing compliance testing of law enforcement equipment. Contacts with the testing laboratories will be made via advertising in the Commerce Business Daily, via communications with testing laboratory trade associations and via contacts made at the suggestion of the LLSL program managers. Efforts will be focused on program areas for which NILECJ performance standards have been or are about to be issued. All responses from testing laboratories relating to individual NILECJ standards will be tabulated. Groundwork will be laid for the use of a computerized information storage and retrieval system when the data base becomes appropriately large.

Finally, the participating laboratories will be evaluated using the developed criteria. The results of these evaluations, together with the evaluation criteria utilized, will be reported to NILECJ.

OBJECTIVES

The outputs of this project are (1) a tabulation of testing laboratories grouped by their stated interest in doing compliance tests for each NILECJ standard, and (2) a laboratory evaluation report for each group of laboratories in (1) above, along with the criteria used in making the evaluation. The attached table shows the projected milestones for tabulation and evaluation of laboratories interested in doing compliance testing for the first NILECJ standard. Milestones for subsequent standards will be set later, based on the experience of tabulating and evaluating the first group of laboratories.

LEVEL OF EFFORT

\$80,000 is requested for FY-74. Since this is an open ended project, additional funds will be requested in the future.

DIRECTORY OF PRIVATE AND PUBLIC TESTING LABORATORIES

Milestones*

Objectives	Assumed Starting Date	#1	#2	#3	#4
Tabulation of testing laboratories interested in compliance tests for first NILECJ Standard	July 1973	NA	NA	November 1973	March 1974
Evaluation report of laboratories tabulated above	NA	NA	NA	January 1974	May 1974

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Bullet and Impact Protective Equipment

Ronald C. Dobbyn, Acting Program Manager
Protective Equipment

SCOPE

This project involves all commercially available ballistic and impact protection equipment.

BACKGROUND

A variety of bullet-protective items are now available, including body armor, handheld shields, ballistic helmets, bullet resisting motorcycle windshields and clipboards, transparent and opaque patrol car armor, etc. A great variety of materials are used in these products, and their protective ability ranges from that against small caliber handgun bullets to armor piercing rifle fire. Often the threat to an officer, who may or may not be wearing armor, comes in the form of a knife or other sharp, pointed weapon, rather than a firearm. This is the situation, for example, in New York City in over fifty percent of the assaults on policemen. There is much confusion about the capabilities of these items to counter various threats and a consequent need for objective evaluations, unbiased information, and detailed guidance.

Recent increases in civil disorders have created an increased need for items such as riot helmets, shields, and outercoats which protect against impact by clubs and thrown missiles rather than bullets. It should be noted that helmets used by motorcycle police and officers in highway patrol cars are intended mainly to protect against accidental rather than intentional injury, yet are quite similar to riot helmets in function.

PROPOSED PLAN

Because of the large number of items involved, and their life-and-death importance to law enforcement officers, LESL has established a small group which is wholly dedicated to the needs of NILECJ and LESL in this product area. Individual equipment items are addressed in the priority order as established and modified by NILECJ.

Since there are a relatively small number of brands and models of most ballistic and impact protective items on the market, and since the police are vitally concerned with the performance of each one of them, we evaluate most or all of them during the testing phase that normally precedes the drafting of each standard or guideline.

Tasks to be addressed during FY-74 are the development of a test for the resistance of body armor to penetration by knives, the development of an improved method of mounting armor for the ballistic penetration test, and the incorporation into the ballistic penetration test of the use of precision handloaded ammunition.

OBJECTIVES

The objectives of this project for FY-74 are standards for impact protective helmets, bullet protective handheld shields, bullet protective helmets and helmet face shields, and a revised standard for police body armor. A guideline for hearing protectors will also be completed.

Anticipated milestones are given in the attached chart.

LEVEL OF EFFORT

The \$110,000 requested for this project for FY-74 will support a three-man group consisting of a project engineer, a junior professional and a technician. This is a modest increase over the \$100,000 budgeted for FY-73.

REMARKS

Already developed under this project are standards for the Ballistic Penetration of Police Body Armor and for Hearing Protectors for Use on Firing Ranges.

BULLET AND IMPACT PROTECTIVE EQUIPMENT

Milestones*

Objectives	Assumed Starting Date	#1	#2	#3	#4
Standard for Impact Protective Helmets	Continuing	Completed	Completed	Completed	December 1973
Standard for Bullet Protective Shields	Continuing	Completed	Completed	Completed	December 1973
Standard for Bullet Protective Helmets	Continuing	Completed	September 1973	November 1973	June 1974
Standard for Face Shields	Continuing	Completed	September 1973	November 1973	June 1974
Guideline for Hearing Protection on Firing Ranges	Continuing	Completed	Completed	Completed	January 1974
Revised Standard for Police Body Armor	August 1973	November 1973	March 1974	May 1974	December 1974

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Standard Sizing of Police body Armor

Ronald C. Dobbyn, Acting Program Manager
Protective Equipment

BACKGROUND

Police body armor is one of several specialized equipment items that requires sizing if maximum effectiveness is to be achieved. This is especially true of the armor designed to be worn under the everyday uniform or street clothing of the officer; however, it applies equally to the larger, externally-worn armors. Fit is directly coupled to comfort in that fit affects the overall weight distribution of the armor over the wearer's body. Fit also determines the areas of the body protected. Thus, armor sizing not only affects maneuverability but may determine whether or not the armor will be worn.

One of the major projects in the LESL Protective Equipment Program is an anthropometric study of law enforcement officers. This project will generate the necessary data on the torso that will permit the inclusion of meaningful sizing requirements into a revision of the current police body armor standard.

The use of existing anthropometric data would not be proper since most of it has been obtained by studies on graduate students, military personnel, the general public, or other special populations.

PROPOSED PLAN

This project will be coordinated with those phases of the anthropometric study of law enforcement officers dealing with the torso. The resulting data will be analyzed in the light of the specific requirements for body armor.

OBJECTIVES

The goal of this project is the incorporation of necessary sizing requirements into a revised standard on police body armor. Projected milestones are given in the attached chart.

LEVEL OF EFFORT

This project is budgeted for \$60,000 and will be conducted in NBS.

STANDARD SIZING OF POLICE BODY ARMOR

Milestones*

Objectives	Assumed Starting Date	#1	#2	#3	#4
Revised Standard for Police Body Armor	May 1974	June 1974	October 1974	December 1974	July 1975

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Guideline for Lights and Sirens

Avery T. Horton, Program Manager
Emergency Equipment

SCOPE

The purpose of this project is to prepare a document which will present information in a practical format to purchasers and users of emergency signaling equipment. It will stress the need for standardization, methods of upgrading existing equipment and guidelines for purchasing new equipment based on the best state-of-the-art information available.

BACKGROUND

Flashing lights and sirens are the principal devices used on emergency vehicles during emergency runs to attract attention and provide safety to the operators of the emergency vehicle and the citizens in its environment. The standards for lights and sirens are procurement aids, but do not provide sufficient information on selection rationale to satisfy all needs. There is a need for a tutorial document that will supply the user with objective information and assist him in making rational decisions.

PROPOSED PLAN

The guideline will cover the following topics:

1. The present situation (some facts about standardization or its absence).
2. What can be done about the warning signal problem (how the proposed solutions relate to existing equipment and standards).
3. Are these approaches realistic in terms of timing, costs, needs of users? What are the chances of success?
4. What is the range of possible approaches? (Upgrading current capabilities, redesigning systems based on better data).
5. Insights and conclusions from LESL's on-going studies of sirens and lights.

Three basic sources of information will be used in the writing of the guidelines:

1. The survey of studies dealing with the responses of people to warning signals (now in preparation).
2. The experimental data obtained during the laboratory and field tests of lights and sirens.
3. The findings of interviews, questionnaires, meetings, etc., designed to determine the requirements of the users.

Using these data as a basis, a report will be written in non-technical language to serve as a guideline for users and purchasers of warning signal equipment.

OBJECTIVE

The objective of this project is the production of a guideline for emergency lights and sirens. The projected milestones are given in the attached chart.

LEVEL OF EFFORT

The work will entail 4/10 of a manyear and a total estimated cost of 20K.

REMARKS

This project is an extension of the on-going effort to develop standards for warning lights and sirens.

GUIDELINE FOR LIGHTS AND SIRENS

Objectives	Milestones*				
	Assumed Starting Date	#1	#2	#3	#4
Guideline on Emergency Vehicle Lights and Sirens	Continuing	Continuing	July 1973	September 1973	January 1974

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

Project Plan for
Anthropometric Study of Law Enforcement Officers

Avery T. Horton, Program Manager
Clothing

SCOPE

This project involves the design and conduction of an anthropometric study to obtain and analyze data on a representative sample of U. S. law enforcement personnel which can be used as a rational and scientific basis for specifying the dimensions of certain specialized equipment and clothing.

BACKGROUND

The law enforcement officers of the United States constitute a unique segment of the population because of the requirement by many law enforcement agencies that personnel conform with specified age, weight, and height criteria. To achieve maximum effectiveness in the procurement of specialized equipment and clothing for this group, it is necessary to have a scientific knowledge of their special anthropometric characteristics. This information does not currently exist, and it is the purpose of this project to provide it.

PROPOSED PLAN

Phase I--Development of Survey Plan

Design of the detailed study plan, which includes development of the desired outputs, the data requirements, the methodology for analyzing and presenting these data in a useful format, and the detailed planning for the field survey effort.

1. The following anthropometric data will be collected:
 - a. Torso measurements (for sizing of uniforms, body armor, etc.)
 - b. Head measurements (for sizing of helmets, hats, gas masks, and other protective head and face gear)
 - c. Hand and finger measurements (for sizing of gloves, handguns, etc.)

- d. Seat torso and arm reach measurements (for sizing of vehicle interiors, motorcycle and motor skooter control arrangements, and other seating and control situations)
2. The design of a sampling plan to obtain the above data for a representative number of the male law enforcement officers in the various kinds and sizes of law enforcement agencies in appropriate geographic areas of the conterminous 48 states.
3. The design of a field survey effort to collect the anthropometric data identified in the detailed study and sample plans. This will include:
 - a. The design and validation of anthropometric data forms, questionnaires, and measurement methodology
 - d. The selection of the law enforcement agencies from which data will be collected in accordance with the sample plan. Initiation and completion of arrangements with those agencies for gathering the anthropometric data.
4. A survey of manufacturers of law enforcement clothing and selected special equipment will be conducted to determine what anthropometric data are presently being used and what additional data are required to produce more effective products.

Phase II--Conduct of Study

The actual collection of the anthropometric data will be accomplished by a sufficient number of teams to complete the study in a reasonable time period. These teams will consist of trained anthropologists, supervised by a professional analyst or psychologist.

Phase III--Data Analysis and Report

1. A statistical analysis will be conducted of the anthropometric measurements collected in the field. This analysis will develop distributions, averages, standard deviations, variances, and other appropriate statistical measures, by kind and size of law enforcement agency and by geographic area.
2. A final report will be prepared which will summarize the findings of the field measurement survey and the survey of manufacturers of law enforcement clothing and equipment.

OBJECTIVES

The output of this project will be a final report. The milestones are shown on the attached chart.

LEVEL OF EFFORT

The total cost of this project is estimated to be 140K. The work will be performed by the Naval Electronics Laboratory Center in San Diego, California, with appropriate assistance from outside consultants.

REMARKS

This project was approved and funded at the 30K level in FY-73.

Milestones*

Assumed Starting Date	#1	#2	#3	#4
Continuing	October 1973	January 1975	June 1975	August 1975

Objectives

Report on Anthropometric Survey of Law Enforcement Officers

*Milestone 1 Completion of the survey of existing equipment, standards and test methods, and of detailed planning for further work.

*Milestone 2 Completion of the laboratory testing, analysis and evaluation of the data.

*Milestone 3 Completion of the first draft of the document by the project staff and its acceptance by LESL.

*Milestone 4 Completion of technical review and formal submission of the document to NILECJ.

PUBLICATIONS OF THE
LAW ENFORCEMENT STANDARDS PROGRAM

Standards

- NILECJ-STD-0101.00, March 1972. Ballistic Resistance of Police Body Armor (Stock No. 2700-0155; Price 25 cents)
- NILECJ-STD-0102.00, March 1973. Hearing Protectors for Use on Firing Ranges (Stock No. 2700-00182; Price 40 cents)
- NILECJ-STD-0205.00, June 1973. Mobile Antennas (in press)
- NILECJ-STD-0301.00, March 1974. Magnetic Switches for Burglar Alarm Systems (Stock No. 2700-00238; Price 65 cents)
- NILECJ-STD-0302.00, June 1973. Mechanically Actuated Switches for Burglar Alarm Systems (in press)
- NILECJ-STD-0601.00, June 1973. Walk-Through Metal Detectors for Use in Weapons Detection (in press)

Reports

- LESP-RPT-0201.00, May 1972. Batteries Used with Law Enforcement Communications Equipment: Comparison and Performance Characteristics (Stock No. 2700-0156; Price 50 cents)
- LESP-RPT-0202.00, June 1973. Batteries used with Law Enforcement Communications Equipment: Chargers and Charging Techniques (Stock No. 2700-00216; Price 80 cents)
- LESP-RPT-0203.00, June 1973. Technical Terms and Definitions used with Law Enforcement Communications Equipment (Radio Antennas, Transmitters, and Receivers) (Stock No. 2700-00214; Price \$1.55)
- LESP-RPT-0301.00, June 1973. Survey of Image Quality Criteria for Passive Night Vision Devices (in press)

- LESP-RPT-0302.00, May 1973. Test Procedures for Night Vision Devices (in press)
- LESP-RPT-0501.00, May 1972. Emergency Vehicle Warning Devices--Interim Review of the State-of-the-Art Relative to Performance Standards
- LESP-RPT-0701.00, May 1974. Life Cycle Costing Techniques Applicable to Law Enforcement Facilities (in press)
- NBS Technical Note 752, June 1973. Directory of Law Enforcement and Criminal Justice Associations and Research Centers

Guidelines

NILECJ-GUIDE-0301.00, April 1974. Selection and Application Guide to Fixed Surveillance Cameras (in press)

Please order publications for which a price is indicated by title and stock number, and enclose remittance payable to the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.

Single copies may be obtained from the National Criminal Justice Reference Service, Law Enforcement Assistance Administration, U. S. Department of Justice, Washington, D. C. 20530.

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16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.) Plans are presented for nineteen projects approved and funded for FY-74. They include plans for the preparation of performance standards, user guidelines and reports on law enforcement equipment in the communications, security, protective equipment, investigative aid, emergency equipment and clothing areas.			
17. KEY WORDS (six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons) Anthropometry; communications equipment; forensic science; Law Enforcement Standards Laboratory; LESL; performance standards; project plans; protective equipment; security equipment; standards; warning lights and sirens			
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